

HEMI-SYNC AND MUSICAL INTERVAL IDENTIFICATION

A Report on "An Assessment: The Effectiveness of Hemispheric Synchronization of the Brain as a Learning Tool in the Identification of Musical Intervals"

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INTRODUCTION

The Monroe Institute of Applied Sciences¹ was founded in 1971 by its executive director, Robert A. Monroe, for the purpose of systematically and scientifically exploring expanded states of human consciousness. Prior to and immediately following the establishment of the Institute, most of the subject experimentation involved individuals who learned to control, sustain and deepen the hypnogogic state--the "twilight area" between normal consciousness and the sleep state. (This particular state and its neurophysiological characteristics have been documented for many years.) By far the most difficult aspect of this research was the problem of sustaining this particular state of consciousness. All too often, subjects would fall asleep and effectively put an end to the research session.

In the mid-1970's, with the growing interest in brain hemisphere research and theory, the Monroe Institute developed a technique to assist in controlling the elusive hypnogogic state, and found that this technique could also be used to induce other states of consciousness as well, along a continuum from deep comatose sleep to states of intolerable high anxiety. They had found a rather simple means of altering the frequencies of the dominant brainwave patterns.

Various physical states (awake, drowsy, asleep, etc.) display their own characteristic brainwave patterns. Such psychophysiological correlates can be demonstrated and monitored on a dual-trace EEG. For example, our normal state of everyday waking consciousness is typified by dominance (greater amplitude/intensity) of beta (13-30 cps.) and alpha (8-13 cps.) waves. In a relaxed unfocused state there is a reduction of beta intensity and an increase in alpha prominence. during deep sleep there is a correlative rise in amplitude of theta (4-8 cps.) and delta (0.1-4 cps.) waves. (This is an oversimplification of subtle brainwave activity, but a model which is useful in general explanation.) What was remarkable about the Institute's discovery was that these various physiological states could be induced if the dominant brainwave frequency/amplitude patterns were externally changed.

HEMI-SYNC: THE TECHNIQUE AND THE PHENOMENON

What they had discovered in 1975 was that the brain responds to a "difference frequency" which results when a sound signal (sine wave) of a particular frequency is applied to one ear and a signal of a slightly different frequency is applied to the other ear. If the

difference between the two frequencies falls within the electrical response range of the brain, the brain responds in kind to generate a change in its own pattern that is similar to the "difference" frequency. Inherent in this response is an increase in intensity (amplitude) at or near this frequency as well as changes in the amplitudes of the other brainwave states. The term for this brain behavior is Frequency Following Response (FFR). For example, if a 200 cps. signal is placed in one ear and a 205 cps. signal in another, the difference between the two signals (205 - 200) is 5 cycles per second. The listener will hear both of the external signals and will also perceive the difference frequency as a wavering "beat" frequency. FFR generation is enhanced when the signals enter the ears through stereo headphones. A FFR can be induced with loudspeakers, but the acoustical properties of the room can create patterns of interference.

Because each hemisphere of the brain processes information from the opposite side of the body, both hemispheres must work in unison to "hear" the difference frequency. Evaluation of EEG tracings showed that there was a synchronicity of brainwave amplitude in both hemispheres. This phenomenon is abnormal in that the two hemispheres tend to generate amplitude signals somewhat independent of each other during normal consciousness, with considerable fluctuation of amplitudes at various frequencies. This unusual condition of a constant amplitude of electrical activity throughout the electrical response range continuum of the brain is referred to as hemispheric synchronization of the brain, or "Hemi-Sync" for short. In May of 1975, Robert Monroe was granted a patent for this application of psycho-physical entrainment via sound patterns.

Such synchronization of equal-amplitude-at-equal-frequency can be demonstrated on a dual-trace EEG monitor, or on a simplified system called a "Mind Mirror" which shows amplitudes of electrical brainwave activity in a lighted bar graph fashion (similar to wattage output bar-graphs on recently designed stereo amplifiers). A more detailed description of this device is contained in the appendices.

The Hemi-Sync phenomenon produces a coherent mind-brain state of mentation. This is quite unlike normal mentation, where "the right hemisphere doesn't know what the left hemisphere is doing." Normal consciousness produces a considerable amount of random electrical activity, just as an incandescent light bulb emits random (unfocused) light. Hemi-Sync is analogous to a laser, in which light emitted is coherent and focused. Additionally, there appears to be an integration of left- and right-brain functioning.

Institute research into the combining of more than one difference frequency led to other findings. By carefully controlling the prominence of beta, alpha and theta frequencies through various difference-frequency "formants," various mental states could be enhanced for particular human functions. Included were concentration for study purposes, deep relaxation and stress reduction, increased creativity, and immediate recall of previously learned (but non-conscious) skills and information.²

The discovery of the most effective difference-frequency combination to aid in concentration came about through a tedious and time-consuming "trial-and-error" approach. A primary difference signal of about 4 cps. (theta-delta threshold) established desired physical relaxation, and other difference frequencies layered above the primary signal effected changes in both beta, theta and delta amplitudes. Faster frequencies prevented the listener from falling off to sleep. An increase in theta-frequency amplitudes seemed to enhance concentration, learning and recall. It was also discovered that the desired response of an individual could depend on a frequency difference as slight as .01 cycle-per-second! The solution was found in increasing and decreasing the speed of the difference frequencies along a continuum in order to "trigger" and "lock in" that pattern idiosyncratic of the individual himself. In other words, the difference combinations would assist the individual to enter into his own "natural" mode of focused concentration. A description of the various frequency combinations produced by the Hemi-Sync Synthesizer (model 202) and their use within the learning environment is provided in the appendices.

BACKGROUND OF THE RESEARCH PROJECT

The Professional Division of the Monroe Institute of Applied Sciences published accounts of remarkable skill and learning enhancement using the Hemi-Sync method in the early 1980's. In one report, a "normal" subject was able to multiply two eight-digit numbers in his head with 100% accuracy while in Hemi-Sync. In his normal state of consciousness, he faltered in multiplying two two-digit numbers with accuracy. A controlled study done in 1981 at the Tacoma Community College in the state of Washington showed that Hemi-Sync signals proved effective in focusing concentration and in attenuating wandering attention in a college classroom. In this study, psychology classes tested 10% higher with Hemi-Sync than without. (A summary report of this study is given in the appendices of this paper.) JoDee Owens, who introduced Hemi-Sync in her first grade classroom in the Tacoma Public Schools found that her students were able to learn a year's worth of material in one semester. She offered the equipment to other teachers in her school, and their responses to classroom use can be found in the appendices of this paper. It seemed appropriate for me to apply the Hemi-Sync technique to an immediate pedagogical concern: ear training!

Cognitive (theoretical/abstract) learning develops faster than "skill-oriented" learning. For many students, there is a lag between the "intellectual-conceptual" and the "aural" components of musical education. Because necessity is the mother of invention, the time seemed right to try an experimental project in the college classroom to assess the Hemi-Sync potential for accelerating the development and accuracy of aural skills.

METHOD

Early in Fall Semester, 1984, all students enrolled in Ear Training I in the School of Music at UNC-Greensboro were invited to participate in this study. It was hoped that the entire class of 75 students would participate. As it turned out, about 45 actually committed themselves to the study. The majority of the subjects were 18 to 19 years old, enrolled in their first semester of post-secondary education, and approximately 70% of the subjects were female. (This percentage is consistent with the overall student-gender ratio within the university.)

The students were informed that I was doing a study to see if a taped lecture/demonstration of melodic and harmonic intervals would help them to learn to correctly identify them. They were not given the particulars of the Hemi-Sync technique, but were informed that the study was sanctioned by the UNC-G Human Subjects in Research Advisory Board. They were also informed that their participation (or lack of participation) in this project would have no bearing upon their final semester grade. (The intent was to remove the study from any academic context for fear that they would spend a number of hours in a practice room working on the intervals at the piano, and contaminate the results.) The number of tape hearings was controlled.

I was provided the last four digits of their social security numbers for identification purposes. The control and experimental groups were determined by ordering the numbers from low to high, and alternately separating the numbers into two groups to assure random selection. A double blind was set up whereby the Music Listening Center had files for each subject, with codes indicating which tapes were to be distributed to each subject. The Listening Center staff were informed of the distribution and collection methods only, and were not aware of the exact nature of the project.

It was my intent to have a "controlled" study. Practical consideration, on the other hand, meant that I would have to accept many uncontrolled variables within the framework of the study. Those included the potential for distraction in the Listening Center, the ambient noise of talking and the sounds of doors opening and closing, which increased or decreased at various times of the day. Given the testing environment, there was a "real life" quality to the situation. This seemed, in many respects, more appropriate than the typically "sterile" environments of many "controlled" research projects.

With the irregularity of the subjects' class schedules, it was impractical to assign each to a fixed time-slot to control the temporal distances between tape hearings. Therefore, there was no control over hour-of-the-day when students would listen. Another significant variable was the anxiety and preoccupation associated with the approach of final exams. (A number of students put off their tape hearings until the last minute, and this became a factor for them.) The only requirements were that they listen to the tape in its entirety six times, and complete all tests per listening

session. They were not allowed to rewind the tape during a listening experience for additional interval hearings (on either the tests or the lecture/demonstration), and were not to listen to the tape if they were under the influence of any drugs or alcohol.

The tapes for the experimental group were processed and bedded with a Hemi-Sync signal from my "master" by Dave Wallis at the Monroe Institute. The duration of each tape was about 40 minutes. Each tape contained a pre-test, a lecture/demonstration covering each of the intervals (both melodic and harmonic), and a post-test. The tapes were identical in content for both groups except that the experimental group's tapes contained the 4 cps binaural beat frequency.

The pre-test and post-test each contained fifteen test items. The tests were in a multiple-choice format, and subjects were to circle the appropriate interval abbreviation corresponding to the interval heard. (These abbreviations were very familiar to the subjects.) For each of the tests there were five melodic intervals ascending, five melodic intervals descending and five harmonic intervals. Each of the three modes of presentation were different for each successive interval heard. Subjects were allowed two hearings per interval with approximately five seconds between the first and the second hearings. A synthesizer was used to generate the musical portions of the tape, and the tone quality was similar to the sound of a piano. The register of the intervals performed was divided equally between male and female speech ranges in order to minimize a "gender bias" within the study.

At the end of the semester all folders were collected and the results were entered into a computer. Scoring was based upon the number of correctly-identified intervals for each pre- and post-test. The Academic Computing Center at UNC-G processed the data. With the assistance of Dr. David Ludwig, a statistician at the Computer Center, a program was designed to evaluate the data. The "group" results were interpreted for me by Dr. Ludwig.

RESULTS

There was no main effect of grouping ($p > .05$). As a whole, both groups did not differ significantly in their learning behaviors. Each group did not display any significant differences in their effects of instruction (as determined by the post-tests) nor did they differ significantly in their responses for each of the six listening sessions. In other words, comparing the fourth session results for the two groups did not show significant differences in group behavior ($p > .05$). There was a small instruction-by-day interaction ($p = .062$), but the effect of instruction (lecture/demonstration) became smaller in the later listening sessions. This may be interpreted to mean that the effect of instruction is important early on, but has less of an impact as the students progress through the six sessions.

In general, the experimental group scored slightly higher than the control group, and maintained its higher scores consistently throughout. Standard deviations for the control group ranged from 2.73 to 3.24; for the experimental group the range was from 2.99 to 4.13. (There was more deviation from the norm within the experimental group.)

The following table shows the mean pre-test/post-test differentials for both groups. The numbers represent mean correct responses out of a possible 15.00. The first column contains means for the first sessions only; the second column contains means for listening sessions 2 and 3 combined; the third column shows the means for listening sessions 4 through 6 combined.

| | <u>Session 1</u> | <u>Sessions 2-3</u> | <u>Sessions 4-6</u> |
|---------------------------|------------------|---------------------|---------------------|
| <u>Control Group</u> | | | |
| Pre-test: | 6.105 | 7.684 | 8.789 |
| Post-test: | 7.210 | 8.105 | 8.000 |
| <u>Experimental Group</u> | | | |
| Pre-test: | 6.850 | 7.600 | 9.150 |
| Post-test: | 8.000 | 8.550 | 9.950 |

An average of pre-test and post-test means show the cumulative differences between the two groups:

| <u>Control Group</u> | <u>Experimental Group</u> |
|------------------------------|------------------------------|
| Pre-test Mean: 8.306 | Pre-test Mean: 8.579 |
| Post-test Mean: 7.936 | Post-test Mean: 8.939 |
| Response Differential: -.370 | Response Differential: +.460 |

There is a group difference of .830 between response differentials. This amounts to an average 5.54% difference. (On a test, this would translate into a "fractional grade" change, from B to B+, or B+ to A, for example.)

The tables on the following pages show the individual pre-test/post-test differentials for each subject. A positive integer indicates that the subject scored that many more correct answers on the post-test than on the pre-test. (A negative integer indicates that the subject scored that many less correct answers on the post-test.) Also provided for each table are the individual difference means and group tallies of positive, negative and no-difference responses.

CONTROL GROUP: Pre-test/Post-test Differentials

Pre-tests = T1, T3, T5...T11; Post-tests = T2, T4, T6...T12

| <u>Subject</u> | <u>T2-T1</u> | <u>T4-T3</u> | <u>T6-T5</u> | <u>T8-T7</u> | <u>T10-T9</u> | <u>T12-T11</u> | <u>Individual Means</u> |
|----------------|--------------|--------------|--------------|--------------|---------------|----------------|-------------------------|
| 5370 | +4 | -2 | +2 | -4 | +4 | -6 | -.333 |
| 2654 | -1 | +2 | 0 | -2 | +2 | 0 | +.167 |
| 3085 | 0 | -1 | -2 | -2 | -1 | 0 | -1.000 |
| 4490 | -2 | 0 | -2 | -2 | -8 | -5 | -3.167 |
| 5718 | +5 | +5 | 0 | 0 | +3 | -3 | +1.667 |
| 5896 | +2 | 0 | -2 | +2 | 0 | +3 | +.833 |
| 6734 | 0 | 0 | -2 | -2 | -2 | -3 | -1.500 |
| 3444 | +1 | +2 | -2 | -3 | -1 | -6 | -1.500 |
| 7652 | +1 | +1 | -2 | -1 | -2 | -3 | -1.000 |
| 8120 | 0 | +1 | +2 | -1 | -2 | -2 | -.333 |
| 8497 | -3 | 0 | -1 | -1 | 0 | +2 | -.500 |
| 2485 | +5 | 0 | +2 | +3 | +4 | +9 | +3.833 |
| 4179 | -1 | -1 | -2 | -5 | -3 | -3 | -2.500 |
| 6054 | 0 | 0 | 0 | -1 | -5 | -5 | -1.833 |
| 2732 | +4 | -1 | -7 | 0 | -4 | -4 | -2.000 |
| 9468 | +3 | -1 | -3 | -1 | 0 | 0 | -.333 |
| 9601 | 0 | +2 | +4 | +1 | -1 | ms | +1.200 |
| 7186 | -1 | -1 | -1 | -2 | -4 | ms | -1.800 |
| 4738 | +4 | +2 | +1 | ms | ms | ms | <u>+2.333</u> |

Mean: -.4087

Responses (N = 109)

+ = 31
 - = 56
 0 = 22

EXPERIMENTAL GROUP: Pre-Test/Post-test Differentials

Pre-tests = T1, T3, T5...T11; Post-tests = T2, T4, T6...T12

| <u>Subject</u> | <u>T2-T1</u> | <u>T4-T3</u> | <u>T6-T5</u> | <u>T8-T7</u> | <u>T10-T9</u> | <u>T12-T11</u> | <u>Individual Means</u> |
|----------------|--------------|--------------|--------------|--------------|---------------|----------------|-------------------------|
| 1632 | +2 | +2 | +2 | +2 | 0 | -2 | +1.000 |
| 2865 | +4 | +2 | +1 | +1 | +1 | +1 | +1.667 |
| 5346 | +4 | -1 | 0 | -1 | 0 | 0 | +.333 |
| 5796 | +1 | +6 | -3 | +2 | -2 | -2 | +.333 |
| 5977 | +1 | +2 | +4 | 0 | +2 | -6 | +.500 |
| 7040 | +1 | +3 | +3 | -4 | -2 | -1 | 0.000 |
| 9502 | +2 | +3 | +2 | -3 | +2 | -1 | +.833 |
| 0803 | +2 | +5 | +5 | -4 | -3 | 0 | +.833 |
| 4492 | -2 | -3 | -1 | +5 | +1 | 0 | 0.000 |
| 7206 | +3 | +2 | +1 | -1 | -4 | -1 | 0.000 |
| 7651 | -2 | +1 | +1 | +1 | +1 | +1 | +.500 |
| 3480 | -3 | +2 | 0 | -1 | -3 | -3 | -1.333 |
| 5460 | +2 | +1 | +2 | +3 | 0 | -3 | +.833 |
| 8081 | +2 | -1 | +4 | +1 | +4 | +1 | +1.833 |
| 4460 | +1 | +1 | 0 | 0 | +1 | -1 | +.333 |
| 3422 | +1 | -3 | +1 | -4 | 0 | 0 | -.333 |
| 8521 | +1 | -2 | +1 | +2 | ms | ms | +.500 |
| 8391 | -4 | -4 | -2 | -5 | ms | ms | -3.750 |
| 6348 | +3 | +5 | +1 | ms | ms | ms | +3.000 |
| 2728 | -1 | -2 | -4 | ms | ms | ms | -2.333 |
| 2496 | +6 | +1 | -2 | +3 | ms | ms | +2.000 |
| | | | | | | | Mean: +.298 |

Responses (N = 114)

+ = 62
 - = 39
 0 = 13

DISCUSSION

Both groups showed a slightly arched learning response curve, an increase in learning into the third and fourth sessions followed by a "learning loss" at the end of the sessions. This "learning loss" is attributed to a number of factors, the most prominent being boredom with the research project, a begrudging student commitment to fulfill the required number of listenings, and the pressures and preoccupations of final examinations.

The intent of the study was to determine the potential of Hemi-Sync for accelerated learning behavior. The results indicate that the sum response differential for the experimental group was 5.54% higher than the control group. The increase was evident, but not "significant" according to standard statistical methods of analysis.

A surprise finding in the study was that individuals in the experimental group had a tendency to achieve higher scores on their post-tests than on their pre-tests. It appears that the Hemi-Sync signals sustained their levels of concentration during the course of the 40-minute tape sessions. An examination and comparison of data on the tables on pages 7 and 8 (the individual pre-test/post-test differentials) indicate that only 28% of the individual responses in the control group post-tests were higher than the pre-tests. On the other hand, the experimental group did much better in individual responses on their post-tests 54% of the time. Post-test scores were negative ("learning loss") 51% of the time for the control group, whereas the experimental group experienced negative scores 34% of the time. When computing the average differential for each subject within each group, 67% of the experimental subjects had a positive average. Positive averages in the control group occurred in only 32% of the cases. Below are the group summaries.

Control Group

Positive Differentials: 31
(28.4%)

Negative Differentials: 56
(51.4%)

No Change: 22 (20.2%)

Positive Subject Means: 6
(31.6%)

Negative Subject Means: 13
(68.4%)

Experimental Group

Positive Differentials: 62
(54.4%)

Negative Differentials: 39
(34.2%)

No Change: 13 (11.4%)

Positive Subject Means: 14
(66.7%)

Negative Subject Means: 4
(19.0%)

No Change Means: 3 (14.3%)

During the process of correcting each individual score sheet by hand it became apparent that the experimental group was having difficulties correctly identifying the Perfect Octave interval! Consistently, they chose to identify it as a Minor Sixth. Upon listening to the experimental-group tape, the reason for this error was obvious: the 4 cycle-per-second difference frequency was interfering with their perception of the interval "quality" itself. The Hemi-Sync signals had not been sufficiently masked. Students were responding to the gestalt sonority which contained the wavering of overtone interference. Their perception (either conscious or nonconscious) of this "dissonance" led them to select a non-octave interval on the basis that the octave is a pure consonance, containing no overtone waverings. The Minor Sixth was for them the "best" interval choice. The effect of the Hemi-Sync signals upon their perception of the other intervals is not known. It is quite possible that the research findings might have been quite different, had the masking been more effective.

CONCLUSIONS AND ADDITIONAL COMMENTS

Within the parameters of this study, an acceleration of learning (from session to session) was not statistically demonstrated. Sufficient masking of the Hemi-Sync signals may have produced significantly different results, and this will be the basis for a future study.

The individual success rate of achieving higher post-test scores in the experimental group suggests that their concentration was more focused during each tape session. This corroborates the findings of Edrington⁶ which indicate that wandering attention is greatly reduced within the Hemi-Sync environment. Hemi-Sync does not transform inattentive students magically into accomplished listeners. The role of the teacher is always crucial. The Hemi-Sync signals assist rather than force; they are a palliative for wandering attention, not a panacea.

The efficacy of such signals in modifying behavior and sustaining student attention was clearly demonstrated during the Musicianship Classes I taught in July, 1985 at the UNC-G Summer Music Camp. Having heard "horror stories" of student misbehavior during these classes for the previous two years--and this being the first time that I was to teach them--I set up a pair of loudspeakers in the front of the room facing the class and ran the Concentration Tape (developed and marketed by MIAS) for their first one-hour class meeting. The results were amazing. In spite of the acoustical anomalies created by the room brought about by the use of stereo loudspeakers (standing waves, phase shifts, wave interference and nodal points), the Hemi-Sync signals brought about a cooperative learning environment. Given the fact that there were up to 125 elementary and junior high students per class and that most of them were not delighted to be required to attend "class" during the summer, the cooperation and social harmony present during the

first day was truly remarkable. Their first class set in motion an attitude toward learning and listening which prevailed for the remaining four days when the signals were not present.

In the Musical Interval Identification study, as well as in the Musicianship Classes reported on directly above, there is no hard evidence that validates or demonstrates a synchronized state on the part of each student. It would be mechanically impossible to hook up all students to an electroencephalographic device in the classroom!! Researchers must look for behavior changes in the groups themselves.

The Hemi-Sync phenomenon is dependent upon psychophysiological entrainment. The time required for such entrainment to occur varies from one individual to the next. It is possible for the student or subject to reject the effect of the signals both objectively and subjectively. Also, the difference-frequency "formants" must be appropriate to the intended task at hand. The "appropriate" brain-state most conducive to cognitive learning differs from the state most conducive to creativity, for example.

It is the hope of this researcher that applications of Hemi-Sync will be explored by others in the field of music not only in the classroom situation but outside of class as well. Those in the area of music therapy may wish to examine its potential as an ambience in their rehabilitation work. The characteristic reduction in physical stress and anxiety brought about by the 4 cycle-per-second signal may be quite useful in pre-performance situations as an alternative to chemical means (tranquilizers and "beta-blockers") of reducing tension. Avenues for possible research seem to be limited only by the interest and creativity of the individual researcher himself.

NOTES

1. The Institute is located near Faber, Virginia (about 20 miles southwest of Charlottesville). For additional information regarding the work and research of the Institute, write to: Jean Wallis, Professional Division, Monroe Institute of Applied Sciences, Route 1, Box 175, Faber, Virginia 22938, or call: (804) 361-1252.
2. These are the primary applications within the field of music study and performance. Other applications are discussed in "Conceptual Discussion of Work Plans" by Dr. Bill D. Schul. (This paper is available through MIAS.) An extract from this artical is presented in Appendix E.
3. See the extract from Dr. Schul's paper, in Appendix E.
4. See Appendix C.
5. The reports of JoDee Owens' use of Hemi-Sync in the classroom are on file at Tacoma Community College, Tacoma, Washington, 98465.
6. This conclusion was drawn by Prof. Devon Edrington after five years of experimentation and evaluation of Hemi-Sync in the classroom. A discussion of his work can be found in his paper, "A Palliative for Wandering Attention" which was given at the First Annual Professional Seminar at the Institute in 1983. (A copy of this paper can be obtained from MIAS.)

APPENDICES

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APPENDIX A: The "Mind Mirror"

The "Mind Mirror" is an electronic bi-lateral electroencephalographic device that displays both amplitude and frequency of the right and left hemispheres in graphic form. Originally designed for bio-feedback purposes, it is used in the Laboratory at the Monroe Institute of Applied Sciences to verify and demonstrate synchronous brainwave patterns in laboratory subjects. The Mind Mirror used in the MIAS Laboratory is a model OP-1, designed and manufactured by Audio Limited in London, England.

A Mind Mirror is a system that consists of a headband harness with electrodes positioned for temporal and occipital pickups on both left and right hemispheres, a shielded interconnect cable, an electronic display unit, and a battery power pack.

The electronic display unit breaks down the brainwave signals into discrete frequency components and displays them in a bar graph format by means of rows of colored lights to show increasing amplitude. Using narrow band-pass filters, the discrete frequency components can be obtained. These discrete frequencies along with the specific brainwave state categories are:

| <u>Brainwave State</u> | <u>Frequency in Hz</u> |
|------------------------|------------------------|
| | 40 |
| | 33 |
| BETA | 26 |
| | 20 |
| | 16 |
| | 12 |
| ALPHA | 10.5 |
| | 9.0 |
| THETA | 7.0 |
| | 5.0 |
| DELTA | 3.0 |
| | 1.5 |

Mind Mirror runs in the Laboratory were started in May, 1985. These runs were video taped and show hemispheric brainwave activity patterns and contain the audio dialogue of the subjects and the monitor/facilitator.

APPENDIX B: The Hemi-Sync Synthesizer (Model 202)

The Hemi-Sync Synthesizer Model 202 is an electronic device that will provide an audio environment enabling the listener to focus upon a chosen task. The synthesizer produces Hemi-Sync signals and automatically mixes them with music or other material from an external tape recorder. This composite sound consisting of the Hemi-Sync sound patterns and the music is then amplified and played over external speakers or stereo headphones. Speakers provide a Hemi-Sync background for regular classroom activities while stereo headphones can be used to make full use of the brain's involvement in mixing frequencies.

The sound frequencies utilized in the Hemi-Sync Synthesizer Model 202 are designed solely for educational or learning modalities and as such, are not necessarily useful or valid in any other applications.

Two speakers and/or a set of stereo headphones can be connected to the synthesizer. The built-in amplifier provides 1 watt RMS per channel. A standard $\frac{1}{4}$ inch stereo phone jack is provided for headphones. Two RCA phono jacks are provided for speaker connections--one each for left and right speakers. Two RCA phono jacks are provided for music inputs. These are the same as the jacks typically found on cassette tape decks and other stereo equipment. Cords with matching plugs are readily available from stores selling stereo equipment.

Every learning situation is unique, as is every learner. Thus the teacher must be sensitive to the situation and select the correct Hemi-Sync setting. The suggestions given here are intended to be used only as a starting point. Depending upon the teacher's style, the type of student, and the situation, the teacher will decide the most appropriate pattern of signals for optimum benefit. Typically an elementary teacher will use "R" for the first few minutes after students come into the classroom to help them settle down, followed by "A" for cognitive learning. Where the teacher has students for only one hour, the use of "R" may be appropriate in some cases (junior high students!) and not in others. Again, the teacher is in the best position to judge. The following are the various settings available on Model 202, with a brief description.

TEST - For testing automatic Hemi-Sync level control.

OFF - For listening to music without Hemi-Sync. This setting allows the operator to do a controlled study in a classroom or on an individual basis to test the effects of Hemi-Sync.

R - RELAXATION (Theta mixed with Delta)

It is a well-known fact that sustained concentration upon a task is difficult when a person is in an excited state. Students who have come from the playground or from any activity involving considerable sensory stimulation have difficulty "settling down" to an intellectual task. Use of the "R" position for a few minutes greatly accelerates the calming process. The teacher should be alert for signs of drowsiness when "R" is in use, since prolonged exposure often results in sleepiness. Ordinarily, three to five minutes on "R" is adequate to produce a calm, relaxed class.

I - IMAGING, AFFECTIVE LEARNING (Theta)

The use of guided imagery is gaining acceptance rapidly in education. The "I" setting greatly enhances imaging ability. Whether the teacher makes conscious use of imaging techniques or not, there is no doubt about the importance of imaging (particularly visual and auditory) for learning. Thus, the "I" setting is indicated during any period that students are listening to a story, watching a film, drawing, composing, dealing with spatial relationships, or engaging in any right-brain activity. Extended use (thirty minutes to an hour) may result in drowsiness. If this becomes the case, switching to "IA" will permit continuation of the activity in progress.

IA - IMAGING AND ATTENTION (Theta mixed with Beta)

This setting is useful for arousing students who have become drowsy during a long session. The "IA" setting is also appropriate for those areas of cognitive learning for which visual and auditory imagery are central, as in geometry, music theory, and foreign languages.

A - ATTENTION FOCUSING, COGNITIVE LEARNING (Theta/Delta/Beta)

Optimal cognitive learning is achieved with a relaxed body and an alert mind. The "A" setting assists learners in reaching and maintaining this state. This is the most frequently used setting since most classroom learning (particularly in secondary and post-secondary education) is cognitive. If you notice the students becoming too relaxed, change to "IA". Part of the problem may be that you are accustomed to squirming, distracted students, that the sight of a classroom of calm, attentive learners leaves you with the impression that something is wrong.

You should not expect dramatic and instant results. Hemi-Sync as a background to classroom activities is a subtle thing. You must be prepared to use it for a month or two before seeing clear-cut effects, and even then you may find the results more obvious to others who are not with the students on a day-by-day basis.

APPENDIX C: Hypermnnesia Experiment by Devon Edrington.
(Reprinted with permission of MIAS.)

Psychology 100, Spring Quartet 1981, Tacoma Community College in Tacoma Washington. There were 24 students in the experimental group and 24 students in the control group. The tapes used were made especially for Devon Edrington by the Monroe Institute of Applied Sciences. Students in the experimental group had no access to the texts or tapes. Students in both classes were taught by the same teacher, Richard W. Giroux. The experiment was conducted by both Giroux and Edrington.

| TEST # | EXPERIMENTAL MEAN (tape) | CONTROL MEAN (no tape) | EXPERIMENTAL STAND. DEV. | CONTROL STAND.DEV. | T TEST | SIGNIF. @ .05 |
|--------|--------------------------|------------------------|--------------------------|--------------------|--------|---------------|
| 1. | 79.44 | 73.07 | 14.45 | 14.43 | 1.5564 | not sig. |
| 2. | 76.71 | 65.92 | 12.37 | 15.11 | 2.9207 | < .05 * |
| 3. | 80.38 | 70.84 | 12.26 | 12.53 | 2.7732 | < .05 * |
| 4. | 83.84 | 73.92 | 9.96 | 11.99 | 3.1809 | < .05 * |
| 5. | 72.00 | 58.91 | 14.62 | 14.68 | 3.0925 | < .05 * |
| 6. | 66.64 | 54.88 | 17.92 | 14.28 | 2.5655 | < .05 * |
| All: | 76.56 | 66.37 | 14.68 | 15.46 | 5.9160 | < .05 ** |

- * Test 2 significant level beyond .01.
- * Test 3 significant level beyond .02.
- * Test 4 significant level beyond .01.
- * Test 5 significant level beyond .01.
- * Test 6 significant level beyond .02.

** Overall significant level far beyond .001.

The essential features of the experiment are: Students in both the experimental and control groups heard the same lectures, read the same books, took the same tests, and were placed into groups on the basis of the last digit of their social security numbers to ensure randomness. Students in the experimental group were required to listen to each tape twice. The cognitive material to be learned was mixed with Bob's [Robert Monroe] master tape, and no student had access to the scripts. Of course, the students in the control group were not allowed to listen to any tape. The cognitive material consisted of sentences which extended to a maximum of four seconds reading time. They were recorded by the teacher of the class so that the voice would be familiar to the students. The cognitive material consisted of definitions of terms peculiar to the discipline of psychology and fundamental concepts in learning theory, personality theory, etc.

Of course we are all aware that an experiment of this sort can yield misleading results due to the fact that the experimental group is given salient features of the course, whereas members of

the control group are left to their own devices to ferret out the salient features. I anticipated that by insisting that the teacher provide to the full class (consisting of the experimental and control groups) during lectures the same statements that were made on the tapes. Of course in the lectures these statements were not identified as salient features; they were merely mixed in (in an appropriate, non-obtrusive way) with the narrative.

Combining all six tests, the experimental group scored 10.19 percent higher than the control group, which, by most grading standards, translates into at least one letter grade higher.

Submitted by Devon Edrington
Professional Member (MIAS)

APPENDIX D: Some Reports From Teachers Using Hemi-Sync (JoDee Owens)
(Reprinted with permission of MIAS.)

The following are some typical reports from teachers who have used Hemi-Sync in their classrooms. Several of these teachers had used Hemi-Sync for only a short time before writing their reports. The original reports are on file at Tacoma Community College.

[Fourth grade, regular students] This teacher had borrowed the equipment for a one week trial. At the end of the first day using Hemi-Sync, the teacher said of herself: "This day went quite well and at 2:30, my usual time to feel 'done in', I didn't feel so tired. In fact, I felt great when the day ended." On the last day the equipment was used, the teacher received several comments from students: "During math a girl came up and said, 'Can you turn that stuff on again while we do our math? It makes me feel good!' Another said, 'When I came in I felt uptight, nothing had gone right. But I feel better now.'"

[Grades 1-6, special education] "Although I do not feel confident making any broad statements concerning the validity of the Hemi-Sync Synthesizer, I do feel that it generally had a positive effect on my classroom environment. If I would have been able to use the Hemi-Sync Synthesizer for several months, rather than just eight hours, I do believe that I would have some very supportive information. My students enjoyed the experience and I felt very influenced by the sounds and music. After five hours of constant stimulation, I felt calm and very 'within myself.'"

[First grade, regular] "For the last sixteen years I have taught primary children and have 'put up' with their wandering attention. . . I now wish I could have learned this fairly simple, but apparently effective aid much, much sooner."

[Grades 6, 7, and 8, special education] "Day one -- Math Class utilizing Hemi-Sync: . . . The entire class was in their assigned seats and was doing the assigned work much sooner than usual. The students were very involved in their assignment. When talking did occur, it was concerning their math assignment. Whenever a disruption did occur, the students immediately returned to being on task."

Day two -- . . . There was a feeling of calmness in the classroom. The students were behaving and responding in a more relaxed than usual manner. The on task periods were much longer time spans than usual. There was a much greater involvement towards the academic aspects. Cooperativeness prevailed! Again, the students immediately went to work and stayed on task.

Day one and two -- Study Skills Class utilizing Hemi-Sync: This is the last class of the day and is usually a 'rowdy' and restless class. The majority of the students settled down earlier into the class period. The Behavior Disordered student was much more calm and quiet and this behavior appeared sooner than usual. . . The atmosphere was more mellow because the students were behaving more quietly and calmly.

Because I was impressed with the positive changes that were occurring in my classes, I shared the tapes with some fellow teachers. The teacher in another Special Education classroom noticed that there was a great reduction in the amount of talking. The art teacher used the tapes extensively and noticed an improvement in the students' drawings. These drawings exhibited more imagination and an improvement in the line development. The teacher felt there was a better attitude and feeling, on the students' parts, towards art and the class."

[Grades 1-6, basic skills] "Before I began using the masked frequencies and imaging techniques, their efforts were hit and miss. They felt inept and clumsy, often referring to my room as the 'dumb room.' I felt defeated and useless at times. Now I use these students as 'teachers' back in their own classes where these techniques have achieved as much success."

[First grade, regular] "On Friday, May 25, the students were tested in the areas of dictation, spelling, and a timed (10 minutes) 100 problem addition test for math. I then ran comparisons with the tests (similar in nature, but not the same tests) which had been given the week before. In dictation the range of scores ran from 04% to 100% for the week before Hemi-Sync was introduced. The mean was 77.83%. After using the Hemi-Sync equipment, the range of scores went from 08% to 100%, with the mean at 79.67. Spelling scores ran from 0% to 100% for the week before Hemi-Sync, with a mean of 82.92. The week of the 22nd, the range was 50% to 100%, with the mean of 91.5. Math time tests given the week of 5/14 ranged from 04% to 100%, with a mean of 84.88. Those time tests given after a week of Hemi-Sync ranged from 22% to 100%, with a mean of 92.42.

In addition, creative writing showed some marvelous gains as a result of our experiment. For example: "My brain is smart. It is working rite now to help me on Fridy with the test and the spelling test. But today's work is easy and my blood is like litning in the sky."

[Third grade, regular] "Nine out of 22 students handed in papers with zero or 1 error on the whole test. Others all accomplished A's or B's -- this is the best performance I have had all year!" (It was a spelling test.)

[Kindergarten, regular] "Imagery is one of the most powerful tools I have ever used to understand the unlimited capabilities of the mind. It is the space of unrestricted creative play. . . . This fascinating technique will be used on a regular basis to telescope and amplify their bountiful and hidden treasures."

[High school, physical education] "I noticed the students (some of them) were closing their eyes and getting into their weight lifting. At the same time their technique while lifting was superb. The students tend to get sloppy while lifting; I felt the music helped them to concentrate and helped them perform better. The students' overall attentiveness had greatly improved. The actual rotating went more smoothly than it had ever gone before. Students behaved with confidence and didn't need to ask 'where the next station was.'"

[Eighth grade, regular and gifted] "Now, after using the tape for three complete weeks, I am fully convinced it calms the students and centers their attention. If I forgot to put it on, the students ask, 'Where is the music?' which, to me, indicates that they like and want it. It has definitely become an integral part of our classroom; a tool I'm delighted to have found and one I plan to continue using."

[Grades 1-6, special education] "My eight hour use of the Hemi-Sync sounds/music and creative imagery gave me a clear idea of the value of this method of self-realization and self-growth. . . One reason why the students may have maintained alertness was because I kept the 22 Hz switch on while they were imaging."

[Grades K-6, special education via a "resource room"] "My boss stopped by on the 17th and left shaking his head in disbelief mumbling, 'The school is a mess today except Resource Room.'"

Note: The "equipment" used in the various classrooms were stereo cassette players or turntables, an amplifier, a pair of loudspeakers and a Hemi-Sync Synthesizer Model 201. The synthesizer used by JoDee and the others has an extra frequency setting, but it has a distinct disadvantage to Model 202. The 202 Model is designed in such a way that changes in volume in the music effect a similar change in volume of the Hemi-Sync signals. This allows for a constant masking of the signals, whereas the 201 model would produce signals of equal dB intensity regardless of the dynamic changes in the music itself.

Musical selections used for the various classes were non-obtrusive. Familiar music (popular and classical) should be avoided because these kinds of music draw attention to themselves. Music with a distinct beat, which compels students to move and with large, sudden changes in dynamic levels should be avoided. "New Age" music and certain kinds of "pattern" music are most effective. The volume level should be kept on the soft side. [G.D.C]

APPENDIX E: Conceptual Discussion of Work Plans (Excerpt) Bill Schul.
(This excerpt is reprinted by permission of MIAS)

[The following excerpt (taken from pp. 9-12) from Dr. Schul's article is intended to give the reader a more in-depth discussion of Hemi-Sync and its applications in non-musical areas of human endeavor. G.D.C.]

The Monroe Institute discovered that phased sine waves at discernible sound frequencies, when blended to create 'beat' frequencies within the ranges of electrical brain waves found at the various stages of human sleep, will create a frequency following response (FFR) within the EEG pattern of the individual listening to such audio waveforms. The FFR in turn evokes physiological and mental states in direct relationship to the original stimulus. With the availability of this tool, it becomes possible to develop and hold the subject into any of the various stages of sleep, from light Alpha relaxation through Theta into Delta and in REM (dreaming). A generic patent on the method and technique was granted to the originator, Robert Monroe.

The goal was to move consciousness (CS) into sleep patterns and still maintain CS as it is understood in the waking state. Experimental sessions with a number of subjects revealed that CS in and of itself became enhanced rather than restricted. Not only was the subject able to ease through the normal diminution of physical sensory input in sleep, without loss of CS, but it was found that CS was not dependent upon these same physical sensory signals. It was further discovered that CS became greater in its capacity without the heavy physical sensory data presenting strong interference and distortion. The determination that thinking, cognition, self, personality, and any other components of consciousness are not dependent upon sensory signals was in itself a most profound learning process to most participating subjects.

It was found that the beat frequency patterns could be applied binaurally, i.e., that one set of signals be inserted in one ear, another in the other ear. In open air, extremely low frequency brain wave patterns (30 Hz - 1.5 Hz) were below audio perception levels, thus, the pattern was expressed in amplitude rather than actual frequency of the sound itself. The effect of binaural insertion implied a possible synthesis of the beat frequency by the brain itself. A 200 Hz signal in one ear and a 210 Hz signal in the other could suggest to the brain an effective 10 Hz resonance.

The results were spectacular. A quantum jump in the entire process became evident. Time of response shortened, duration extended, degree of intensity was dramatic, all in the FFR patterns shown in EEG traces. The period that followed was one of exploration of

response to audio frequencies above EEG ranges, and often beyond normal hearing frequencies. The search was aimed at the determination of other effective audio frequencies, whatever such effect might be. The process was a tedious one, as only slow-sweep tests permitted the FFR to appear, due to the time-delay response and the reporting of the subject. Moreover, to be acceptable as to the nature of the response, a double-blind consensus of subjects was a part of the criteria.

A number of definite, repeatable responses were found. Attention could be varied from non-conscious delta sleep of total lack of CS and comatose physical state up through intense beta-type concentration of one-pointed fixation, and into high-anxiety intolerable "nervousness". However, much depended upon the sequence of the signals offered. For example, an extremely "clear" form of mentation was obtained by first aiding the subject to achieve mind-awake-body-asleep through one set of signal stimulation, then applying a second, overlapping signal that would normally be too "nerve-racking."

With the advent of a wide interest in brain-hemisphere theory and study, the Institute undertook to explore the bi-lateral effects of FFR. It was found that extreme disorientation could be produced temporarily by inserting different unrelated signals in each ear. Moving more cautiously, a "de-tuning" of either hemisphere was possible by the insertion of low EEG range frequencies in the opposite ear. Conversely, either hemisphere could be stimulated by the same method, by application of specific beta sound patterns and beyond. The natural outcome of this, to seek patterns which could balance or adjust the relationships between the left and right brain, and help produce desired changes in behavior.

Utilizing the Institute FFR process in the binaural mode, it was found that a bi-lateral EEG on a subject could be established whereby the dominant wave form of each brain hemisphere was displayed on a dual-trace oscilloscope. Binaural beat-frequency stimulation creates a sustaining FFR that is synchronous in both amplitude and frequency between the brain hemispheres.

There is a partial entrainment effect, and there are indications that it can be learned much as in the biofeedback model. Whether the synthesized signal crosses the Corpus Callosum (the nerve network between the brain hemispheres), travels through the brain stem, limbic system--has yet to be determined. It appears that new neural pathways are established as a result.

Work with the Monroe system and the brain hemispheric synchronization-coherence has brought forth a number of interesting prospects. Some of these are:

1. Balanced health: The first and prime effect has been a stabilization of the mental and physical energies of the participant. Most report dynamic changes in physical vitality, more

restful sleep, a greater sense of well-being, a general serenity, new enthusiasm for living, and release from false identities and obligations, to name a few.

2. Stress-Reduction: Used principally in cases that have resisted conventional approaches, results derived appear to be caused chiefly by a change in the overview of the individual, rather than dealing with specifics.

3. Surgical Support: Applied before, during and after surgery. When used in its entirety, this special system helps the patient in reduction of anxieties, control of life energies, reduction of pain, and acceleration of natural body healing. Patients consistently report major gains in all of these areas.

4. Control of Pain: It is not yet clear why the method is as effective as indicated. The suggestion for control of chronic pain would appear to be quite insufficient to provide the dynamic changes reported again and again. As little as one week of work with the tapes has often been sufficient. There is some speculation that it is related to the effect noted in (1) above.

5. Stroke Recovery: Although very little has been done with the Monroe system in this area, the preliminary findings bear reporting. The synchronization of the hemispheres of two participants shortly after the onset of minor strokes, each produced definite improvement in the dysfunction. In one case, the subject had suffered minor speech difficulty and intermittent motor instability in his legs. After three hemi-sync sessions, his speech had cleared considerably, and he was able to walk steadily without effort. Three months later, there had been no retrogression that could be observed.

6. Psychotherapy: When applied in the interview setting, the hemi-sync mode appears to help the patient reach very quickly long-submerged levels which have resisted penetration by most traditional means. It has been stated that 10 interviews using the system may be the equivalent of 10 years of orthodox treatment.

7. Problem Solving: The coherent brain-mind focused in a given area by specific FFR patterns apparently has a far greater capacity to view any condition from a holistic position than "normal" capacity consciousness. It can be speculated that it is the result of simple utilization of completer interaction between brain hemispheres. In a demonstration with a group of forty five executives of a major corporation, participants were asked to seek the best answer they could for his own individual problem, while experiencing hemi-sync. Thirty reported decision-solutions of a quality for the most part unexpected. Each was sure it was the "right" answer.

8. Accelerated Learning: The pure synchronization effect alone offers many potentials on several levels of learning by the simple provision of focusing of attention. For example, its use by students while studying enhances retention and recall. One college

student was able to raise her college grades from 2.5 to 3.9 average in one quarter, using the method. Another test showed an ability to perceive and remember oral information at a rate of 1,000 words per minute. (A speech compressor was used to create the material.) Another participant was able to multiply two eight-digit numbers mentally, with 100% accuracy; without the hemi-sync effect, he had difficulty with sets of two-digit numbers. Multiplication tables from 13 to 24 were used as rote material, with 60% accuracy in recall after one session. Under the same conditions, mental-physical coordination activities were simulated with a form of guided imagery. Particular tests were performed chiefly in sports where any changes could be measured. The most indicative of these took place where six golfers all reduced their scores by as much as five strokes. The implication that the method could be employed in more constructive directions and in many forms appears to be limited only by the need.

9. Creative Stimulus: A well-known training authority stated that over 30,000 engineers on the company payroll, savings and/or profits could be increased by some \$200,000,000 if this employee group added 2% to their creative ability. Response in this area from the Monroe system has been consistent and perhaps one day the Institute will be able to conduct such an extensive study as this. Tests already performed with a small and diverse engineering group some eleven in number have shown probability to surpass easily such percentile. Several in the group have developed new designs in their respective fields which were interesting enough to warrant patent application. One participant in another Monroe program became inspired to write a book, completed it and sold it to a publisher within six weeks. A second became proficient and prominent as a commercial artist, a third turned composer and arranger. Several hundred have come forth with new ideas, methods, concepts and viewpoints that have brought major changes in their life styles. The value of the latter can be assessed only by the individual at first, and subsequently by those around him.

The preceding [sic] is not to be construed as research protocol for brainwave training and monitoring of psychophysiological correlates. Rather it is an informal discussion of some of the concepts and underlying principles involved in these efforts. A study of the terrain excites the imagination and the purpose of this paper is to excite others with the view. The implications are profound. Hopefully, we can contribute something to their investigation.

APPENDIX F: Ethical Considerations and Other Thoughts

From the foregoing information, the positive impact of Hemi-Sync upon the individual in particular and the society in general is quite profound. In spite of the salubrious benefits that can be derived from this method, there are critical questions that remain to be answered. What "right" does anyone have to alter the brainwave patterns of another individual? At what point does the "right" of "advised consent" become an issue, especially when working with youngsters? In what capacity can these same techniques be used in a negative, destructive and detrimental way (such as "brainwashing" and so forth)? I am not an authority, by any stretch of the imagination, in the areas of ethics, morality, philosophy or theology. There are others more qualified than I to sufficiently answer these questions. Nevertheless, I would like to share my own thoughts on these issues.

First of all, what "right" does a person have to alter the brainwave activity of another person? This question naturally arises when discussions of possible classroom use are undertaken with educators, school administrators, and those unfamiliar with the Hemi-Sync technique. It presupposes that each of us are in some way "in control" of such patterns, when in fact we usually are not. Our brainwave activity, for the most part, is controlled by outside stimulation. We respond to external stimuli in the world around us and within us most of the time on a non-conscious level. For example, if a driver quickly cuts in front of our car while driving during "rush-hour," we do not respond by thinking about the changes produced in our brain's electrical patterns!! We do, however, experience a sense of sudden shock, followed by anger and an increase in nervous tension. We are not in control of how our brains operate on the biochemical/electrical level.

More specifically, in the classroom the teacher and the environment are all factors affecting the student's brain-mind state. An energetic and motivating teacher (by his very presence and effective teaching style) produces changes in the electrical patterns which are conducive to successful learning; s/he is able to elicit focused attention and concentration because s/he assists the students to generate brainwave patterns most conducive to learning. On the other side of the coin, a hot classroom in the afternoon coupled with an uninspired instructor who rarely changes the inflection of his soft-spoken voice will produce brain patterns which lull students to sleep. What "right" do we have to externally control another person's brainwave states? We do it all the time! The only difference is that the "standard" methods of teaching (for better, or for worse!) are sanctioned as time-honored methods.

There is a pervasive fear in our society of things which are new and of things we don't understand. As creatures of habit--a society which finds a sense of security in the status-quo--we tend to

reject things that are new and things that demand a "paradigm shift" in how we perceive the world we live in. (The skeptics would like us to believe, for example, that the lunar landings in the late 1960's were simulations using trick photography to deceive the American public.) A perusal of intellectual history will show at a glance what the impact of new knowledge had upon the societies at various times. Christopher Columbus, while defying the "earth-is-flat" theory was considered a madman by his contemporaries. Collisions between scientific discovery and religion/"normal world view" arise in every generation. When the "sun-revolves-around-the-earth" theory was proven to be false, the author of this "new" paradigm had to fear for his life! (We live in a world of illusions and it is threatening to realize that the "obvious" is anything but "real.") Recent discoveries in quantum mechanics have pushed many of our beloved scientific models to the breaking point. (A number of prominent physicists are now operating in the "speculative mode" of "non-physics!")

To the average person (who just might be interested in human consciousness) Hemi-Sync smacks of a new technology with the potential for going berserk. It might evoke images of a "1984" scenario as a means of "controlling" another person's mind and thoughts. Such misguided thinking has been (and will continue to be) a major stumbling-block in gaining approval of the technique in classroom use. No one's thoughts can be "controlled" by Hemi-Sync. It should also be pointed out that these signals can be objectively and subjectively rejected by an individual and therefore, deviations in student learning responses may vary from day to day. It may be anticipated that certain (prominent?) religious organizations will eventually attack the method as being communistic, totalitarian, or "the work of the devil", but that is to be expected. (Most of us are aware of the religious confrontations of Copernicus, Kepler, Descartes, Galileo, et. al.)

"Advised consent" seems to be more of an ethical issue with controlled studies and research than it does with the application of the technique in general. Within the public school system, approval for Hemi-Sync use must first be granted by the administration, and followed by approval of the teacher using it. The extent of parental involvement in such decisions would vary from one system to the next. In previous large-scale projects (Tacoma Public Schools being the most prominent), there appeared to be little parental concern regarding the implementation of Hemi-Sync. They placed their trust in the classroom teachers and in their elected public-school officials. This does not imply that parents will always be receptive to it. Situations have occurred in the past where a parent was adamantly opposed to Hemi-Sync in her child's classroom, and in this particular case the parent in question refused to be open-minded whatsoever. Her response was based on the "fear factor" cited above. The decision whether to use Hemi-Sync or not in the classroom on the basis of a single (or few) objection would depend upon the school's administrative policies in terms of relocating the involved student into another class section, and so forth. (Schools have had to deal with more explosive and polarizing issues in the past, including evolution vs. creationism, and sex education.)

The question of potential for "abuse" of Hemi-Sync technology has no easy answer. We are all gravely aware of the impact of subliminal advertising in the movie theater, where single-frame shots of various foods were spliced into the movie film to increase intermission confectionary sales. Manipulation through television advertising and subliminal persuasion via the creation of an image associated with a product and the creation of false needs are, so it seems, an "accepted" part of our economy and life-style. Billions of dollars are squandered in order to control the purchasing expenditures of large segments of the society. Yes, it is possible that Hemi-Sync could be used for subliminal control. The extent of such abuse is unknown to me. I believe such employment would be quite limited in scope.

Hemi-Sync is not a "brainwashing" device. There is no text behind the signals. Within an academic setting, Hemi-Sync signals mixed with soft music only provide an ambience--an environment--for enhanced learning, sensitivity and awareness. And, successful learning is predicated on successful and effective teaching strategies. If "brainwashing" is going on in the classroom it is due to the person in front of the class, not the synthesizer.

Nearly every product, device, discovery, etc. offers the potential for abuse or misuse. The harnessing of energy through nuclear fission has on one hand provided us with a means of generating cheap electrical power. On the other hand, it has produced the atomic bomb. The dangers of its peace-time applications are globally significant. If we do not live in constant worry about another Three Mile Island crisis, a truck accident involving the transport of radioactive materials (and those truck routes are kept confidential for a number of reasons!), or radioactive pollution of a large-city water system by a terrorist/madman, this anxiety is ever-present just beneath the surface of our consciousness. Drugs, whether they are of the medicinal or "entertainment" variety, are abused in epidemic proportions in our society. Even the well-intentioned CIA has used them experimentally on subjects, with disturbing results. The list goes on and on...

But to see the beneficial results of Hemi-Sync--the high success rate of prompt recovery of psychological disorders; the reduction intense stress experienced by students at a major medical institution; the remarkably quick rehabilitation of a toddler (labeled an "incurable retarded and autistic youngster, without any hope for recovery...Better to place him in an institution...") by a speech therapist to a point where the child was capable of eating, forming vocal sounds and developing embryonic communication skills, learning to differentiate and "prioritize" the onslaught of incoming sensory input--the potential for "good" far outweighs the potential for abuse.